SECTION 15465

COMPRESSED AIR EQUIPMENT AND SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this section.

1.2 SUMMARY

A. Scope: The work specified in this section includes providing labor, material, equipment, and services necessary for completion of piping systems in a serviceable, fully operational manner.

B. Section Includes: The work specified in this section includes, but is not limited to, providing a complete CDA system as follows:
   1. Piping materials
   2. Valves
   3. Clean Dry Air compressors with moisture separators
   4. Air Receiver Tank
   5. Pre-Filters
   6. Air Dryers
   7. After-Filters and Final-filters

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 15, Section 15050, “Piping Systems”.
   2. Division 15, Section 15072, “Cleaning”.
   3. Division 15, Section 15073, “Pressure/Leak Testing”.
   4. Division 15, Section 15074, “Identification and Labeling”.
   5. Division 15, Section 15112, “Compressed air Piping (Plant Air) Systems”
   6. Division 15, Section 15990, “Testing, Adjusting and Balancing”.

1.3 REFERENCES.

A. Codes: CDA piping shall be installed within applicable provisions of local and state codes.

B. Standards: Items listed to conform to ASTM, ANSI, or other standards shall meet all manufacturing or installation requirements of such standards.

1.4 SUBMITTALS

A. Before installation of work, provide submittals, shop drawings and O&M manuals in accordance with the following::
   1. Submit manufacturer's product data sheets including wiring and control diagrams on the following:
      a. Air compressors, filters, dryers, receiver and automatic drain valves.
   2. Submit supplier’s certification of materials on the following:
      a. Pipes.
      b. Fittings.
   3. Submit shop drawings, layouts of the following:
      a. Piping assembly and related equipment layouts.
   4. Operation and Maintenance Data: For Air Compressor, filters, dryers, receiver and automatic drain valves to include Operation and maintenance (O&M) manuals as specified in general and Supplementary General Conditions.

1.5 QUALITY ASSURANCE

A. Materials received at the job site shall be new, of first quality, and defect free. Materials shall be protected from damage while stored and after installation.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS

A. Furnish and install piping in accordance with Section 15112.

2.2 VALVES

A. Furnish and install valves in accordance with Section 15112.

2.3 CLEAN DRY COMPRESSED AIR SYSTEM (CDA)

A. Provide a clean dry compressed air system consisting of air compressors, filters, dryers and receiver tank.

B. Air compressor shall be a two-stage water-cooled oil free positive displacement rotary screw compressor. Unit shall be fully packaged, including air compressor, coolers, lubrication system, regulation and control systems, mounted on a common base frame and fully enclosed by a steel sound-dampening canopy. The compressor shall consist of two compressor stages flanged to an integral speed increaser. Each stage is to be driven from a common gear to insure optimum speed and efficiency. Multi-stage compressors have an intercooler placed between stages and an aftercooler installed in the package. Silencers, lubricating system, cooling system, control system, and driver shall be mounted as a part of the package.

C. The compressor package shall have the appropriate gauges, controls and indicators as specified below:
   1. Intercooler Air Pressure Gauge.
   2. Discharge Air Pressure Gauge.
   3. Oil Pressure Gauge.
   4. Vacuum Gauge for Air Intake Filter.
   5. Compressor Discharge Water Temperature Gauge.
   6. Aftercooler Discharge Water Temperature Gauge.
   7. 1st and 2nd Stage Discharge Air Temperature Gauges.
   8. Oil Temperature Gauge.
   9. 2nd Stage Inlet Air Temperature Gauge.
   10. High Oil Temperature Light.
   11. Low Oil Pressure Light.
   12. High 1st and 2nd Stage Discharge Air Temperature Lights.
   13. High 2nd Stage Inlet Air Temperature Light.
   14. Hour Meter-Running Time.
   15. Hour Meter-Loaded Time.
   16. Auto Operation Light.
   17. Power On Light.
   18. Motor Overload Light.

D. The compressor package shall have automatic shut-off switches as specified below:
   1. Low Oil Pressure.
   2. High 1st and 2nd Stage Discharge Air Temperature.
   3. High 2nd Stage Inlet Air Temperature.
   4. High Oil Temperature.
   5. Motor Overload.

E. The compressor package shall not exceed 75 dB (A) when measured at one meter from the enclosure.

F. The air compressor unit shall be as manufactured by:
   1. Ingersoll Rand, Sierra series, oil free rotary-screw, scheduled capacity at 150 PSIG with a 460V, 60 cycles, 3-phase TEFC motor. Efficiency at full-load 95.4%.
   2. Atlas Copco.
   3. Hitachi.
   4. Kobelco.

G. Provide three (3) compressor assemblies and one sequencing controller capable of programming all three (3) compressors. The controller shall be set to sequence (by running time), two of the compressors to operate in parallel simultaneously and the third compressor shall be sequenced as a “Standby” to replace either one of the two compressors in case of failure.
   1. The sequence controller shall be as manufactured by the same manufacturer as the CDA package.

H. Compressed Air receiver tank shall be of a vertical configuration. Tanks shall be ASME rated at 150 PSIG including base ring, pressure relief valve, pressure gauge, automatic drain valve, primed and finish painted.

I. Duplex 0.7 micron prefilters (after receiver), shall be Ingersoll Rand (or approved equivalent) multi-stage coalescing filter rated at 150 PSIG.

J. Air dryer system shall be Ingersoll Rand (or approved equivalent) or equal twin-tower heatless desiccant dryer rated at 150 PSIG based on 100 degrees F Inlet Air Temperature (IAT) and –40 degrees F pressure dew point. Dryer assembly shall also include a "compu-purge" control panel.

K. Duplex, 0ne (1)-micron “after-filters” shall be particulate filter rated at 150 PSIG with Stainless Steel housings.

L. Duplex 0.9-micron final-filter shall be a particulate filter rated for 150 PSIG with Stainless Steel housings.

EXECUTION

3.1 GENERAL

A. Miscellaneous:
   1. Install equipment, valves, and devices in strict accordance to manufacturer's recommendations.
   2. Install systems and equipment true and plumb with building components.
   3. Coordinate sequence of work and installation with other trades and contractors.
   4. Replace damaged work with new as acceptable by the Construction Manager.

3.2 INSTALLATION (PIPE AND EQUIPMENT)

A. General: Installation of equipment and material shall be in accordance with applicable requirements.

B. Supports: System piping shall be supported in accordance with acceptable practices, local codes, and applicable standards. Refer to installation instructions and Section 15050, “Piping Systems” and Section 15112, “Compressed Air Piping (Plant Air) Systems.”

C. Escutcheon Plates: Provide escutcheon plates on exposed pipe in finished areas passing through finished floors, walls, and ceiling. Inside diameter shall fit snugly around pipe.

D. Cutting: Cut piping and tubing accurately to measurements established at the building site and work into place without springing or forcing, properly clearing equipment. Take necessary precautions during installation of piping and tubing to prevent entrance of dirt, debris, or other foreign material. Protect exposed open ends of piping on pumps and other equipment with temporary closures until permanent piping connections are made. Before making the permanent connections, carefully inspect and clean the piping and connected equipment. Pipe, tubing, valves, and fittings shall be sufficient distance from other work to permit finish covering and painting if required. Make changes in size with appropriate reducing fittings. Install valves with stems above the horizontal plane. Use no bushings. Use eccentric reducers where required for proper drainage or venting. Make connections to equipment in accordance with the drawings or manufacturer's recommendation.

E. Cleaning: Clean piping not otherwise cleaned, as specified here-in-before, thoroughly inside and outside before installation and maintain in that condition during the entire construction period. Where specific details are not furnished, follow the ANSI codes or manufacturer's recommendations. Clean tubing, valves, and fittings of oil, grease, dirt, and other contaminating materials before installation.

F. Piping Connections: Use threaded or flanged piping connections to equipment and components so that the equipment may be removed or serviced without extensive dismantling of the connecting piping or shutdown of adjacent equipment.

G. Welded Pipe: Weld alloy steel pipe in accordance with AWS. Use welders qualified in accordance with the ASME Boiler and Pressure Vessel Code, Section IX. Weld flanges where called for.

H. Threaded Pipe: After cutting and before threading, ream and remove burrs from pipe. Cut threads full so not more than three threads on the pipe shall remain exposed. When screw joints are encountered, apply Teflon tape to male threads only.

I. Copper Tubing Bends: Make changes in directions requiring turns or offsets of radius less than five times the outside tube diameter by solder type fittings, or by tubing shaped with bending tools. Bends shall be free from any appreciable flattening, buckling, or thinning of the tube wall.

J. CDA Piping and Tubing (CA, PCW):
   1. Experienced tubing installers shall install tubing assemblies.
   2. Care shall be exercised during the installation of the tubing assemblies so as not to remove the end caps prior to installation.
   3. Tubing that require cutting during installation shall be cut only with a degreased sharp rotary type-tubing cutter, and the tubing shall be immediately recapped with a new cap or plug. Tubing shall not be de-burred after cutting. The tubing shall be purged with argon at times when it is open to the atmosphere. An inert high-purity gas atmosphere shall be maintained in the tubing system at all times. Contractor shall supply bottled high purity argon, labor and materials, including purge tubing and regulators.
   4. Assembly Procedures for Copper Pipe:
      a. General: Verify that pipe is free of scale, liquid contaminants, and particulates.
      b. Soldering and Assembly: personnel certified by the Owner shall do Silver soldering of high purity gas piping systems. Keep copper surfaces to be soldered clean and protected with taped polyethylene bags. Soldering shall be silver solder type and constantly surrounded and purged with nitrogen. At no time shall inside surface be exposed to the atmosphere.
      c. Handling: Use particular care in handling materials and maintaining in clean condition the tools used in cutting or shaping, to prevent oil, grease, or debris from being introduced into the pipe or fitting. If such contamination occurs, the items affected shall be re-cleaned as specified.

d. Washing: After cutting and shaping operation, wash the end of the tube in methyl alcohol.
e. Blowing Out: After soldering high purity copper piping in place, but before installation of outlet valves, the line shall be blown clear with argon.
f. Joint Test: After installation of outlet valves, each section shall be subject to a test pressure of at least 1-1/2 times the maximum working pressure, but not less than 150 psi, by dry nitrogen. Maintain test pressure for 24 hours without pressure drop except as adjusted for temperature.

3.3 TESTING OF PIPING SYSTEMS

A. Procedures:
1. Perform testing specified in this section in the presence of the Construction Manager. Provide instruments, facilities, materials, and labor required to properly conduct tests at no increase in the contract sum. Local or state authorities having jurisdiction shall be given due notice of the tests as may be required by them, and acceptance of the work shall be contingent upon acceptance by the public authority. If the public authorities have the jurisdiction, the Construction Manager shall have no authority to accept or reject the test data. The successful completion of the prescribed tests shall be basis for acceptance.
2. The Contractor shall maintain an accurate log of testing and a certified copy of test results shall be delivered to the Construction Manager upon completion of the test.
3. Test pressure shall be 1-1/2 times working pressure but not less than 150 psig.

B. Pressurize and test Compressed Dry Air (CDA) piping systems for leaks by soaping. No drop in pressure shall be noted at the end of 24 hours, other than that due to temperature changes. Piping systems shall be tested in accordance with Section 15073, “Pressure/Leak Testing”.

C. Leaks found shall be repaired in the following manner:
1. Solder Joints: Joint shall be re-made.
2. Screwed Joints: Tighten, do not caulk.

D. Upon completion of the work, valve stems shall be adjusted for use.

E. Testing of Installed CDA Systems:
1. The Contractor shall schedule tests and notify the Construction Manager two days in advance of the time period during which tests will take place. The Contractor shall provide the Construction Manager with a schedule of when he wishes to have individual lines tested two days in advance of tests.
2. Analytical gas purity (cleanliness) tests will be conducted by the Contractor. The Contractor will furnish personnel, equipment, and materials to perform these tests prior to acceptance by the Construction Manager. Test results will be sent to the Construction Manager.
3. After test samples have been taken, the lines shall be capped.
4. The Contractor shall be responsible for assuring the cleanliness of the final installation. The Contractor shall submit a proposed cleaning procedure to the Construction Manager for approval prior to cleaning piping.
5. Engage a factory-authorized service representative to train CM designated operating and maintenance personnel to adjust, operate and maintain compressed air equipment as specified below:
   a. Train maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing and maintaining air compressor systems.
   b. Review data in Operating and Maintenance (O&M) manuals.
   c. Schedule training with CM at least seven days advance notice.
6. Should any piece of apparatus or any material or work fail in any of these tests, it shall be immediately removed and replaced with new materials. The installing Contractor at

contractors' expense shall replace the defective portion of the work and retest the work in the presence of and to the satisfaction of the Construction Manager.

END OF SECTION 15465